

$\eta_c(2S)$

$I^G(J^{PC}) = 0^+(0^{-+})$

Quantum numbers are quark model predictions.

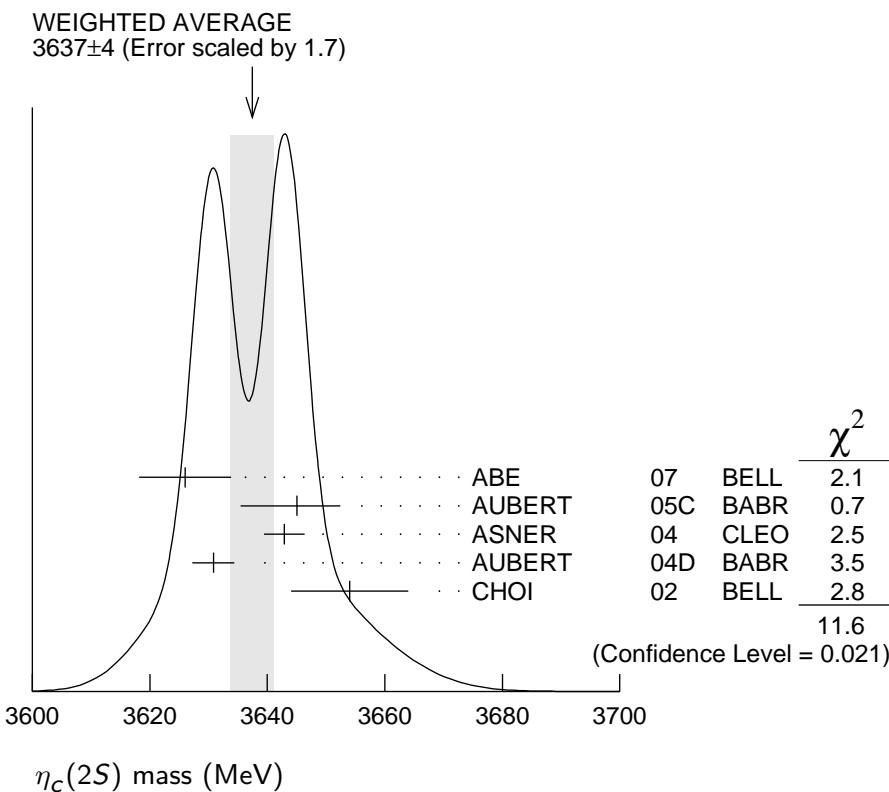
$\eta_c(2S)$ MASS

VALUE (MeV)	EVTS	DOCUMENT ID	TECN	COMMENT
3637 ± 4 OUR AVERAGE				Error includes scale factor of 1.7. See the ideogram below.
3626 ± 5	± 6	311	1 ABE	07 BELL $e^+ e^- \rightarrow J/\psi(c\bar{c})$
3645.0 ± 5.5	± 4.9	121 ± 27	AUBERT	05C BABR $e^+ e^- \rightarrow J/\psi c\bar{c}$
3642.9 ± 3.1	± 1.5	61	ASNER	04 CLEO $\gamma\gamma \rightarrow \eta_c \rightarrow K_S^0 K^\pm \pi^\mp$
3630.8 ± 3.4	± 1.0	112 ± 24	AUBERT	04D BABR $\gamma\gamma \rightarrow \eta_c(2S) \rightarrow K\bar{K}\pi$
3654 ± 6	± 8	39 ± 11	CHOI	02 BELL $B \rightarrow K K_S K^- \pi^+$
• • • We do not use the following data for averages, fits, limits, etc. • • •				
3639 ± 7	± 52	2 AUBERT	06E BABR	$B^\pm \rightarrow K^\pm X c\bar{c}$
3594 ± 5		3 EDWARDS	82C CBAL	$e^+ e^- \rightarrow \gamma X$

¹ From a fit of the J/ψ recoil mass spectrum. Supersedes ABE,K 02 and ABE 04G.

² From the fit of the kaon momentum spectrum. Systematic errors not evaluated.

³ Assuming mass of $\psi(2S) = 3686$ MeV.



$\eta_c(2S)$ WIDTH

VALUE (MeV)	CL%	EVTS	DOCUMENT ID	TECN	COMMENT
14 ± 7 OUR AVERAGE					
6.3±12.4±4.0		61	ASNER	04	CLEO $\gamma\gamma \rightarrow \eta_c \rightarrow K_S^0 K^\pm \pi^\mp$
17.0± 8.3±2.5		112 ± 24	AUBERT	04D BABR	$\gamma\gamma \rightarrow \eta_c(2S) \rightarrow K\bar{K}\pi$
• • • We do not use the following data for averages, fits, limits, etc. • • •					
<23	90	98 ± 52	⁴ AUBERT	06E BABR	$B^\pm \rightarrow K^\pm X_c \bar{c}$
22 ± 14		121 ± 27	AUBERT	05C BABR	$e^+ e^- \rightarrow J/\psi c \bar{c}$
<55	90	39 ± 11	⁵ CHOI	02 BELL	$B \rightarrow K K_S K^- \pi^+$
<8.0	95		⁶ EDWARDS	82C CBAL	$e^+ e^- \rightarrow \gamma X$
⁴ From the fit of the kaon momentum spectrum. Systematic errors not evaluated.					
⁵ For a mass value of 3654 ± 6 MeV					
⁶ For a mass value of 3594 ± 5 MeV					

$\eta_c(2S)$ DECAY MODES

Mode	Fraction (Γ_i/Γ)
Γ_1 hadrons	
Γ_2 $K\bar{K}\pi$	seen
Γ_3 $p\bar{p}$	
Γ_4 $\gamma\gamma$	seen

$\eta_c(2S)$ PARTIAL WIDTHS

$\Gamma(\gamma\gamma)$			Γ_4
VALUE (keV)	DOCUMENT ID	TECN	COMMENT
• • • We do not use the following data for averages, fits, limits, etc. • • •			
1.3±0.6	⁷ ASNER	04	CLEO $\gamma\gamma \rightarrow \eta_c \rightarrow K_S^0 K^\pm \pi^\mp$
⁷ They measure $\Gamma(\eta_c(2S)\gamma\gamma) B(\eta_c(2S) \rightarrow K\bar{K}\pi) = (0.18 \pm 0.05 \pm 0.02) \Gamma(\eta_c(1S)\gamma\gamma) B(\eta_c(1S) \rightarrow K\bar{K}\pi)$. The value for $\Gamma(\eta_c(2S) \rightarrow \gamma\gamma)$ is derived assuming that the branching fractions for $\eta_c(2S)$ and $\eta_c(1S)$ decays to $K_S K\pi$ are equal and using $\Gamma(\eta_c(1S) \rightarrow \gamma\gamma) = 7.4 \pm 0.4 \pm 2.3$ keV.			

$\eta_c(2S) \Gamma(i)\Gamma(\gamma\gamma)/\Gamma^2(\text{total})$

$\Gamma(p\bar{p}) \times \Gamma(\gamma\gamma)/\Gamma_{\text{total}}^2$			$\Gamma_3\Gamma_4/\Gamma^2$
VALUE (units 10^{-8})	CL%	DOCUMENT ID	TECN
< 5.6			
	90	8,9,10 AMBROGIANI 01	E835 $\bar{p}p \rightarrow \gamma\gamma$
• • • We do not use the following data for averages, fits, limits, etc. • • •			
< 8.0	90	8,9,11 AMBROGIANI 01	E835 $\bar{p}p \rightarrow \gamma\gamma$
<12.0	90	9,11 AMBROGIANI 01	E835 $\bar{p}p \rightarrow \gamma\gamma$
⁸ Including the measurements of of ARMSTRONG 95F in the AMBROGIANI 01 analysis.			
⁹ For a total width $\Gamma=5$ MeV.			
¹⁰ For the resonance mass region 3589–3599 MeV/ c^2 .			
¹¹ For the resonance mass region 3575–3660 MeV/ c^2 .			

$\eta_c(2S)$ BRANCHING RATIOS

$\Gamma(\text{hadrons})/\Gamma_{\text{total}}$

<u>VALUE</u>	<u>DOCUMENT ID</u>	<u>TECN</u>	<u>COMMENT</u>	Γ_1/Γ
$\bullet \bullet \bullet$ We do not use the following data for averages, fits, limits, etc. $\bullet \bullet \bullet$				
not seen	ABREU	980	DLPH $e^+ e^- \rightarrow e^+ e^-$ +hadrons	
seen	12 EDWARDS	82C	CBAL $e^+ e^- \rightarrow \gamma X$	

$\Gamma(K\bar{K}\pi)/\Gamma_{\text{total}}$

<u>VALUE</u>	<u>EVTS</u>	<u>DOCUMENT ID</u>	<u>TECN</u>	<u>COMMENT</u>	Γ_2/Γ
seen	39 ± 11	13 CHOI	02	BELL $B \rightarrow K K_S K^- \pi^+$	

$\Gamma(\gamma\gamma)/\Gamma_{\text{total}}$

<u>VALUE</u>	<u>CL%</u>	<u>DOCUMENT ID</u>	<u>TECN</u>	<u>COMMENT</u>	Γ_4/Γ
$\bullet \bullet \bullet$ We do not use the following data for averages, fits, limits, etc. $\bullet \bullet \bullet$					
<0.01	90	LEE	85	CBAL $\psi' \rightarrow \text{photons}$	
12	For a mass value of 3594 ± 5 MeV				
13	For a mass value of 3654 ± 6 MeV				

$\eta_c(2S)$ REFERENCES

ABE	07	PRL 98 082001	K. Abe <i>et al.</i>	(BELLE Collab.)
AUBERT	06E	PRL 96 052002	B. Aubert <i>et al.</i>	(BABAR Collab.)
AUBERT	05C	PR D72 031101R	B. Aubert <i>et al.</i>	(BABAR Collab.)
ABE	04G	PR D70 071102	K. Abe <i>et al.</i>	(BELLE Collab.)
ASNER	04	PRL 92 142001	D.M. Asner <i>et al.</i>	(CLEO Collab.)
AUBERT	04D	PR D92 142002	B. Aubert <i>et al.</i>	(BABAR Collab.)
ABE,K	02	PRL 89 142001	K. Abe <i>et al.</i>	(BELLE Collab.)
CHOI	02	PRL 89 102001	S.-K. Choi <i>et al.</i>	(BELLE Collab.)
AMBROGIANI	01	PR D64 052003	M. Ambrogiani <i>et al.</i>	(FNAL E835 Collab.)
ABREU	98O	PL B441 479	P. Abreu <i>et al.</i>	(DELPHI Collab.)
ARMSTRONG	95F	PR D52 4839	T.A. Armstrong <i>et al.</i>	(FNAL, FERR, GENO+)
LEE	85	SLAC 282	R.A. Lee	(SLAC)
EDWARDS	82C	PRL 48 70	C. Edwards <i>et al.</i>	(CIT, HARV, PRIN+)

— OTHER RELATED PAPERS —

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